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USE OF RIVERS FOR PETROLEUM TRANSPORT

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The share of river transport in the total volume of petroleum carried by USSR railroads and river transport, amounts to about 25 percent of the tonnage and 20 percent of the ton-kilometerage. However, the present amount of petroleum products carried by river transport does not correspond to the great economic advantages of river transport for liquid cargoes. The Volga River is still not sufficiently used for carrying the production of the plants of the middle Volga, especially up the Volga to Moscow and to Leningrad. The Dnepr is not sufficiently utilized for carrying petroleum products to Kiev and the regions of the upper Dnepr.

In regard to transport costs for petroleum products, it should be noted that fixed costs for the river fleet which are connected directly with the size of the freight turnover amount to more than 80 percent of the total cost of the shipping lines, but for the railroad systems, expenditures for rolling stock and crews amount to about 60 percent. Expenditures for track maintenance, which comprise about 18 percent of the cost of freight hauling, are included in the carrying cost of railroad transport. The expenses of the railroad systems connected with track maintenance (rails and ties) are dependent to a great extent on the traffic density.

Expenses for the maintenance of river channels change very little with variations in the volume carried. These expenses do not go into the hauling costs of the shipping lines. Inasmuch as the costs of the various types of transport depend, to a certain degree, on the size of freight turnover, and a change in the volume carried causes a disproportionate change in costs, the comparison of hauling costs should be made by taking into account the actual change in costs for each of the types of transport.

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On the whole, the share of the so-called variable costs (i.e., costs dependent on the volume carried) in river transport amounts to more than 90 percent of the costs of the shipping lines, and in railroad transport, they amount to only 70 percent.

The following table shows the total costs and variable costs for river transport, railroads, and pipelines (based on the indexes of the Volga Tanker Ship Line, which specializes in petroleum carrying on the Volga and Kama).

Comparison of Hauling Costs

Types of Transport and Names of Ship Lines	Total Costs	Variable Costs: Operating Costs	Variable Costs: Terminal Costs
Volga Tanker Ship Line	1	1	1
Moskva-Volga Canal Ship Line	3.2	2.3	1.6
Moskow-Oka Ship Line	2.4	2.6	1.2
Northwestern Ship Line	3.7	2.1	1.2
Dnepr Ship Line	4.7	3.6	2.1
Amur Ship Line	3.8	3.9	2.0
Av for river network	1.4	1.7	1.3
Av for railroad network	4.7	4.4	0.9
Main pipelines, 8-12 in diameter	2.1-1.3	3.4-2.1	--

It is necessary to keep in mind that in river transport the hauling distance is usually an average of 30-50 percent (sometimes even more) longer than by railroad or by pipeline. For instance, the distance from Gor'kiy to Moscow by the Volga through the Moscow Canal is twice as long as by railroad. However, even taking into account the longer river route, the advantages of river transport are still great.

Thus, hauling costs on the Volga, by railroad, and by pipeline, for various distances, are as follows:

Comparison of River, Rail, Pipeline Costs

	500 Km	1,000 Km	2,000 Km
On the Volga, without taking into account the lengthening of the route	1	1	1
On the Volga, taking into account the lengthening of the route	1.3	1.35	1.4
By railroad	2.9	3.4	3.7
By pipeline, 8-12 in diameter	1.9-1.25	2.4-1.5	2.85-1.75

With an increase in the length of haul of petroleum by river transport, the economy increases considerably, and only in comparison with a large-diameter pipeline does this advantage become less when the extra distance traveled by river exceeds 50 percent.

The advantage of river transport in regard to labor productivity is shown by the following example. A 12,000-15,000 ton petroleum caravan, normal for the Volga, is handled by ship and barge crews totaling 40-45 men, which amounts to an average of one man per 300 tons. To carry the same amount of petroleum by railroad would require about ten trains, which would

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require (taking into account three-shift operation) locomotive and train crews amounting to 200-250 men, or one man per 60 tons. A section of pipeline with a 10-inch diameter and a capacity of 12,000-15,000 tons is about 300 kilometers long and is serviced by line and pumping station personnel numbering 200-220 men, about the same as for the railroad.

Even taking into account the seasonal character of river transport (average on the Volga is 7 months out of the year) the productivity of labor expressed in ton-kilometers per man of the basic operating personnel for the Volga Tanker Ship Line is considerably higher than for the railroad systems and for pipelines.

River transport has great advantages for petroleum carrying in regard to requirements in metal for its transport facilities. Thus, in building a tanker fleet for carrying petroleum on the Volga, 50-60 percent less metal is required than would be required to construct tank cars to carry the same quantity, not counting the additional expenditure of metal for rails, and 80-84 percent less is required than would be needed to construct a pipeline with a corresponding carrying capacity. With the present cost of shipbuilding, the correlation of the required capital investments for petroleum carrying for the various types of transport are as follows: on the Volga, 1; by railroad, 1.75; by pipeline, 3.5.

In regard to fuel expenditures, river transport is many times more economical than the railroads. In carrying petroleum products on the Volga by steam-powered boats, the fuel expenditure (expressed in equivalents) is 67 percent less than on the railroads, and with diesel-powered boats, 88-89 percent less.

Pipelines are most economical in regard to fuel expenditure. The expenditure of fuel per ton-kilometer is 60-67 percent less than for steam-powered transport and 35-40 percent less than for diesel-powered transport.

The seasonal character of river transport reduces considerably its economical aspect. Petroleum storage facilities must be built to accumulate stocks of petroleum products in the areas of consumption between the periods of navigation; such facilities must also be built in the areas of production to store what is produced during the winter. However, the large economy of river transport in comparison with rail fully justifies these additional expenditures. The following table shows in rubles the cost per ton of carrying light petroleum products from Kuybyshev to Yaroslavl' (calculation is made on the basis of reported cost for 1949):

Transport of Petroleum From Kuybyshev to Yaroslavl'
(cost per ton in rubles)

	By River	By Rail
Hauling costs	16.1	47.8
Storage costs at Kuybyshev and Yaroslavl' for 5 months	10.1	--
Total	26.1	47.8
Saving achieved by using river fleet	21.7	

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